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Ethnobotanical importance and nutritional potential of wild edible fruits of Meghalaya state in India

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ABSTRACT

The nutritional potential of five wild edible fruits of the plant e.g. Debregeasia longifolia, Helicia erratica, Ilex venulosa, Rhus semialata and Spondias axillaris, collected from Meghalaya state in India were evaluated by determining proximate and phytochemical composition. These plants are used by the local people of Meghalaya state in India as their food. The present study revealed that for different plant species, the crude fat content ranged between 1.07±0.05 -7.39±0.02 % . The crude protein content was determined high in the fruits of Debregeasia longifolia (11.99±0.04%) and Rhus semialata (7.86±0 .03%) while the available carbohydrate content was highest in the fruits of Helicia erratica (88.96±0.07%). The energy content ranged from 342.15±0.13-419.09±0.0 6 kcal/100g in the various wild edible fruits. Among the various macronutrients estimated in the plant samples of different wild edible plants potassium was present in the highest quantity (2.98±0.21- 20.46±0.11 mg / g) followed by calcium (2.06±0.15-19.49±0.18 mg/g) and sodium (0.1 7±0.009-0.81±0.02 mg /g). Micronutrients, such as iron, zinc, copper, manganese and magnesium were analyzed in the different plant specimens. The result indicates that nutritional values and mineral contents of these fruits under investigation were richer than that of the commercial fruits and could be used for nutritional purpose. The present study also gives an account of ethnobotanical importance of the wild fruits under investigation.

Key words: Wild edible fruits , Meghalaya, nutritional composition, mineral contents

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INTRODUCTION

In most developing countries the wild edible plants are good sources of food and provide adequate level of nutrition to mankind. These wild plants serve as an indispensable constituent of human diet supplying the body with minerals, vitamins and certain hormone precursors, in addition to protein and energy [1]. Due to the rich source of minerals and vitamins the wild edible plants can reduce the risk of diseases like diabetes, cancer, coronary heart disease, neurodegenerative ailment [2].

Meghalya is a small state in north-eastern India. It comprises of South Garo hills, West Garo hills, East Garo hills, West Khasi hills, East Khasi hills, Ribhoi and Jaintia Hills districts [3] . The forests of Meghalaya provide a large number of plants whose fruits, seeds tubers, shoots etc make an important contribution to the diet of the tribal people. These plants also provide some useful products like medicine, fibre, fodder, dyes etc [4] . A large part of the region is botanically under-explored or even unexplored. The local inhabitants survive on limited agriculture and local products of plant and animal origin. The area is, thus, very interesting ethnobotanically [5]. Though several investigations has already been done on the nutritive properties of various types of edible wild plants in this

area, much still need to be done. The study of wild edible plants is important not only to identify the potential sources which could be utilized as alternative food but also to select promising types for domestication.

The present communication deals with the analysis of the fruits of *Debregeasia longifolia*, *Helicia erratica*, *Ilex venulosa*, *Rhus semialata* and *Spondias axillaris*, collected from different market of Meghalaya state, India for their nutritional composition and mineral contents. The main target of our research was to find out the nutritional potential of these wild edible fruits. The traditional use and ethnobotanical importance of these plant has also been mentioned.

Debregeasia longifolia (Burm.f.) Wedd. is known as Jallatyrsim in Meghalaya State, belongs to the family Urticaceae. The tender leaves are boiled and taken as food. The fruits are eaten by birds [6].

Helicia erratica Hook.f. is known as Soh Priam Khlaw in Meghalaya State, belongs to the family Proteaceae. The ripe fruits are are eaten raw.

Ilex venulosa Hook.f is known as Soh Phoh Khlaw in Meghalaya State, belongs to the family Aquifoliaceae. The fruits are eaten raw and also cooked as vegetable.

Rhus semialata Murr. (Anacardiaceae) is a deciduous tree of north eastern India. The fruit of this plant is traditionally used to control diarrhoea and dysentery [7]. The small sour fruits and seeds are grounded to make chutney. The seeds and fruits are also soaked in water for few hours and the water is taken to get relief from gastric problem. In Meghalaya the fruits of this plant is known as soh-mlum or sohma.

Spondias axillaris Roxb is known as Dieng-Salait in Meghalaya state, belongs to the family Anacardiaceae. It commonly grows in lower hill forest. The fruit is mostly pickled for future use and also eaten fresh [8].

EXPERIMENTAL SECTION

Plant materials

The five plant materials e.g the fruits of *Debregeasia longifolia*, *Helicia erratica*, *Ilex venulosa*, *Rhus semialata* and *Spondias axillaris*, were collected from different tribal market of Meghalaya state, India on December 2012 and authenticated in our office. The voucher specimens were preserved in the Plant Chemistry department of our office under registry no BSITS 55, BSITS 62, BSITS 59, BSITS 57 and BSITS 52 respectively. The plant parts were shed-dried, pulverized and stored in an airtight container and proximate composition and mineral contents were carried out in our laboratory

Estimation of ash

Five gm of each sample was weighed in a silica crucible and heated in muffle furnace for about 5-6 h at 500^0C. It was cooled in a desiccator and weighed. It was heated again in the furnace for half an hour, cooled and weighed. This was repeated consequently till the weight became constant (ash became white or grayish white). Weight of ash gave the ash content [9] .

Estimation of moisture

Two gm of each sample was taken in a flat-bottom dish and kept overnight in an air oven at 100–110°C and weighed. The loss in weight was regarded as a measure of moisture content [9].

Estimation of crude fat

Two gm moisture free of each sample was extracted with petroleum ether (60-80^{o}C) in a Soxhlet apparatus for about 6-8h. After boiling with petrol, the residual petrol was filtered using Whatman no. 40 filter paper and the filtrate was evaporated in a preweighed beaker. Increase in weight of beaker gave crude fat [9].

Estimation of crude fibre

Two gm of moisture and fat-free material of each sample was treated with 200 ml of 1.25% H_2SO_4. After filtration and washing, the residue was treated with 1.25% NaOH. It was the filtered, washed with hot water and then 1% HNO_3 and again with hot water. The washed residue was dried in an oven at 130^{o}C to constant weight and cooled in

a dessicator. The residue was scraped into a pre-weighed porcelain crucible, weighed, ashed at 550^{o}C for two hours, cooled in a dessicator and reweighed. Crude fibre content was expressed as percentage loss in weight on ignition [9].

Estimation of crude protein

The crude protein was determined using micro Kjeldahl method. Two gm of each sample compound was decomposed by digestion with concentrated sulphuric acid in the presence of a catalyst, ammonium sulphate is produced. An excess of sodium hydroxide solution was added to the diluted reaction mixture, the liberated ammonia was distilled in steam and absorbed in a measured excess of standard sulphuric acid. Titration of the residual mineral acid with standard sodium hydroxide gives the equivalent of ammonia obtained from the weight of the sample taken. From this the percentage of nitrogen in the compound can was calculated. On the basis of early determinations, the average nitrogen (N) content of proteins was found to be about 16 percent, which led to use of the calculation N x 6.25 (1/0.16 = 6.25) to convert nitrogen content into protein content [9].

Estimation of available carbohydrate

Percentage of available carbohydrate was given by: 100 – (percentage of ash + percentage of fat + percentage of protein + percentage of crude fibre) [9].

Estimation of nutritive value (energy)

The three components of foods which provide energy are protein, carbohydrate and fat. One gram carbohydrate and protein yield 4 kcal energy whereas one gram fat yield 9 kcal energy. The energy content of each plant samples were determined by multiplying the values obtained for protein, fat and available carbohydrate by 4.00, 9.00 and 4.00 respectively and adding up the values [9] .

Estimation of minerals in plant material

Plant material was taken in a precleaned and constantly weighed silica crucible and heated in a muffle furnace at 400°C till there was no evolution of smoke. The crucible was cooled at room temperature in a desiccator and carbon-free ash was moistened with concentrated sulphuric acid and heated on a heating mantle till fumes of sulphuric acid ceased to evolve. The crucible with sulphated ash was then heated in a muffle furnace at 600°C till the weight of the content was constant (~2–3 h). One gram of sulphated ash obtained above was dissolved in 100 ml of 5% HCl to obtain the solution ready for determination of mineral elements through atomic absorption spectroscopy (AAS) (AA 800, Perkin- Elmer Germany). Standard solution of each element was prepared and calibration curves were drawn for each element using AAS [10]. All assays were carried out at least in triplicate and values were obtained by calculating the average of three experiments and data are presented as Mean ± SEM

RESULTS AND DISCUSSION

The edible parts of fresh plant materials *e.g* the fruits of *Debregeasia longifolia*, *Helicia erratica*, *Ilex venulosa*, *Rhus semialata* and *Spondias axillaris*, collected from different places of Meghalaya market have a relatively high moisture content when compared to ash, crude protein, crude fat, dietary fibre and available carbohydrate content .

The proximate analysis of the nutritive contents of five fruits are depicted in Table 1. The results obtained from analytic chemical analysis of all five wild edible fruits establishes that nutritive value of

Table 1 Proximate composition of the wild edible fruits collected from Meghalaya state

Name of the Plant	Proximate composition						
	Ash %	Moisture %	Crude fat %	Crude fibre %	Protein % 6.25x % of N	Carbohydrate %	Nutritive value kcal/100g
D. longifolia	16.19±0.02	65.56±0.06	2.39±0.04	1.26±0.02	11.99±0.04	68.15±0.10	342.15±0.13
H. erratica	3.46±0.08	82.48±0.04	1.07±0.05	3.24±0.04	3.26±0.04	88.96±0.07	378.56±0.62
I. venulosa	3.23±0.02	67.34±0.04	1.29±0.04	4.88±0.04	3.27±0.03	87.31±0.04	374.01±0.28
R. semialata	1.58±0.02	12.15±0.04	5.82±0.03	0.92±0.03	7.86±0.03	83.79±0.11	419.09±0.06
S. axillaris	3.53±0.04	62.29±0.07	7.39±0.02	9.35±0.03	1.88±0.04	77.83±0.13	385.40±0.21

Each value in the table was obtained by calculating the average of three experiments (n=3) and data are presented as Mean ±SEM

of *R. semialata* was maximum (419.09±0.06 kcal /100g) followed by *S. axillaris* (385.40±0.21 kcal/100g) and *H. erratica* (378.56±0.62 kcal/100g) . The fruits of *D. longifolia* were found to be of less nutritive value (342.15±0.13

kcal/100g) but due to high ash and mineral content it has a very good nutritive value and may be used as fodder. The crude protein contents ranged from 11.99±0.04 % (*D. longifolia*) to 1.88±0.04 % in the (*S. axillaris*). The crude protein content in *D. longifolia* was found to be higher than the protein content in some commercial fruits like apple (0.2%), wood apple (7.1%) and lichi (1.1%) [11]. These indicates that low cost plant samples are very good sources of protein. The fruits of *H. erratica, I. venulosa* and *R. semialata* with high content of available carbohydrates (88.96±0.07%, 87.31±0.04 % and 83.79±0.11% respectively) compared well to that reported for almond (10.50%), apple (13.7%), wood apple (18.1%), potato (22.6%) and ripe mango (16.9%) [11-12] and these could be a supplements in feed formulations. The ash content was found lowest in *R. semialata* (1.58±0.02 %) and highest in *D. longifolia* (16.19±0.02 %). The fat content in the fruits of *S. axillaris* (7.39±0.02 %) and *R. semialata* (5.82±0.03 %) was particularly high and well compared to that reported for some common fruits like wood apple (3.7%), litchi (0.20%), ripe mango (0.4%) [11]. The fruits of *S. axillaris* contained the highest amount of crude fibre (9.35±0.03 %) and the lowest amount is found in the fruits of *R. semialata* (0.92±0.03%) and simmilar to commercial fruits and vegetables like apple (3.2%), broad beans (8.9%), cabbage (2.8%), potato (1.7%), spinach (2.5%) [11] . The proximate composition of these plants were very much comparable to some other wild edible fruits like *Morus indica*, *Myrica nagi* , *Myrica esculenta*, *Parkia roxburghii*, *Prunus nepalensis*, *Terminalia bellerica* etc, collected from different tribal market of Meghalaya [13].

The edible parts of all plants contain minerals like sodium, potassium, calcium, manganese, magnesium, iron, zinc and copper in varying concentration with potassium having highest concentration and it is shown in Table 2.

Table 2 Minerals content of the wild edible fruits collected from Meghalaya state

Name of the Plant	Minerals present mg /g							
	Na	K	Ca	Mn	Cu	Fe	Mg	Zn
D. longifolia	0.38±0.01	20.46±0.11	19.49±0.18	0.12±0.0002	0.016±0.0001	3.000±0.0008	0.91±0.0001	0.51±0.0001
H. erratica	0.17±0.009	2.98±0.21	2.06±0.15	0.03±0.0001	0.007±0.0002	0.15±0.0001	0.87±0.0002	0.27±0.0002
I. venulosa	0.24±0.01	11.04±0.15	9.18±0.21	0.32±0.0002	0.016±0.0002	0.22±0.0002	0.87±0.0015	0.48±0.0001
R. semialata	0.24±0.01	6.10±0.12	3.35±0.09	0.03±0.0001	0.001±0.0002	0.14±0.0002	0.79±0.0001	0.40±0.0001
S. axillaris	0.81±0.02	10.81±0.20	6.05±0.16	0.05±0.0001	0.052±0.0002	0.37±0.0005	0.85±0.0003	0.30±0.0002

Each value in the table was obtained by calculating the average of three experiments (n=3) and data are presented as Mean ±SEM

High concentrations of sodium (Na) were present, ranging from 0.17±0.009 mg g^{-1} (*H. erratica*) to 0.81±0.02 mg g^{-1} (*S. axillaris*). The sodium levels of some cultivated vegetables and fruits vary between 30-1249 mg kg^{-1} [11] . The potassium (K) content was highest in the fruits of *D. longifolia* (20.46±0.11 mg g^{-1}) and least in the fruits of *H. erratica* (2.98±0.21 mg g^{-1}). Potassium also plays an important role to mental function as well as to physical processes. The proper level of potassium is essential for normal cell function [14]. Na and K take part in ionic balance of the human body and maintain tissue excitability. Na plays an important role in the transport of metabolites and K is important for its diuretic nature. The ratio of K/Na in any food is an important factor in prevention of hypertension and arteriosclerosis, with K depresses and Na enhances blood pressure [15] . The ratio of K/Na were significant in the fruits of *D. longifolia* (53.84), *H. erratica* (17.52), *I. venulosa* (46) *R. semialata* (25.41) and *S. axillaris* (13.34) and very much compared with some common fruits (Amla 45, papaya ripe 12, tomato 47.1, beet 3.9, *Castanea sativa* 56.67, *Punica granatum* 1400.00) [12] . The calcium (Ca) content was remarkably high in the fruits of *D. longifolia* (19.49±0.18 mg g^{-1}) followed by *I. venulosa* (9.18±0.21 mg g^{-1}) and *S. axillaris* (6.05±0.16 mg g^{-1}). The calcium levels of some cultivated vegetables and fruits vary between 0.1-1.300 mg g^{-1} [11]. Ca constitutes a large proportion of the bone, human blood and extracellular fluid. It is also very much required for the normal functioning of the cardiac muscles, blood coagulation, milk clotting and the regulation of cell permeability [10] . In the tissue of many fruits, calcium is one of the mineral believed to be an important factor governing fruit storage quality [14].

Copper is another trace element essential in human body where it exists as an integral part of copper proteins ceruplasmin, the enzyme that catalyzes the oxidation of iron ion [15] . The sufficient amount of copper (Cu) was present in *S. axillaris* (0.052±0.0002 mg g^{-1}), *D. longifolia* (0.016±0.0002 mg g^{-1}) and in *I. venulosa* (0.016±0.0001 mg g^{-1}). An appreciable quantity of Zinc (Zn) was found to be present ranging from 0.27±0.0002 mg g^{-1} (*H. erratica*) to 0.51±0.0001 mg g^{-1} (*D. longifolia*).

Zinc is an essential element in the nutrition of human being where it functions as an integral part of numerous enzymes including some enzymes which play a central role in nucleic acid metabolism. In addition, Zn is a

membrane stabilizer and a stimulator of the immune response. Its deficiency leads to growth failure and poor development of gonadal function [16] .

The Manganese (Mn) concentrations of the plants studied varied between 0.03±0.0001 to 0.32±0.0002 mg g^{-1}. The highest Mn values were found in the fruits of *I. venulosa* (0.32±0.0002 mg g^{-1}) and appreciable amount of this element were observed in all other plants and our results were in the limits. This element is very much essential for haemoglobin formation [10] . Manganese is one of the most important minerals for human physiology and daily requirement for healthy person is 4.50 mg [17] . A very high concentration of iron (Fe) was present in the fruits of *D. longifolia* (3.000±0.0008 mg g^{-1}) and moderate amount of iron was present in *S. axillaris* (0.37±0.0005 mg g^{-1}) and *I. venulosa* (0.22±0.0002 mg g^{-1}). This high Fe levels in some wild edible plants studied could be clarified with different soil characteristics of the growing area. A daily Fe requirement of human body is 15 mg and the deficiency causes some illness like anemia. Wild edible plants studied had sufficient and high Fe levels for human health [17]. The Magnesium (Mg) concentrations of the plants studied varied between 0.663±0.001 to 0.781±0.001 mg g^{-1}. The highest Mg values was found in the fruits of *D. longifolia* (0.91±0.0001mg g^{-1}). A very good amount of Mg is also present in the fruits of *I. venulosa* , *H. erratica* and in *S. axillaris* .

So the mineral findings of all these plants obtained from present study were similar and comparable to the commercial vegetables and fruits.

CONCLUSION

The study showed that the wild edible fruits collected from Meghalaya State in India were rich in protein, available carbohydrate, total dietary fibre and minerals investigated and we believe that these fruits could be used for nutritional purpose of human being due to their good nutritional qualities and adequate protection may be obtained against diseases arising from malnutrition.

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REFERENCES

[1] IE Akubugwo; AN Obasi ; SC Ginika, *Pakistan Journal of Nutrition*, **2007**, 6(4), 323-326.
[2] P Saikia ; DC Deka, *Journal of Chemical and Pharmaceutical Research*, **2013**, 5(3),117-121.
[3] AA Mao ; TM Hynniewta ; M Sanjappa, *Indian Journal of Traditional Knowledge*, **2009**, 8 (1), 96-103.
[4] H Kayang, *Indian Journal of Traditional Knowledge*, **2007**, 6 (1), 177-181.
[5] SK Jain ; N Dam, *Economic Botany*, **1979**, 34, 254-272.
[6] RC Srivastava ; Adi community, *Indian Journal of Traditional Knowledge*, **2009**, 8(2),146-153.
[7] SK Bose ; S Dewanjee ; AS Gupta ; KC Samanta ; M Kundu ; SC Mandal, *African Journal of Traditional and Complementary Medicine* , **2008**, 5 (1), 97-102.
[8] KK Singh ; M Singh ; SC Joshi, *SMU Medical Journal*, **2014**, 1 (2), 283 – 293.
[9]AOAC, Official methods of analysis, 14th edition, Association of Official Analytical Chemists, Washington DC. Arlington, Virginia, USA, **1990**.
[10]AK Indrayan ; S Sharma ; D Durgapal ; N Kumar ; M Kumar, *Current Science*, **2005**, 89 (7), 1252-1255.
[11]C Gopalan, BV Rama Sastri, SC Balasubramanian. Nutritive Value of Indian Foods. Printed by National Institute of Nutrition, Indian Council of Medical research, Hyderabad 500 007, India, **2004**, 2-58.
[12] M Sundriyal ; RC Sundriyal, *Economic Botany*, **2004**, 58 (2), 286-299.
[13]T Seal, *Research Journal of Botany*, **2011**, 6 (2) , 58-67.
[14]KM Venkatesh ; G B Jagadish ; B M Somaraddi; C V Gouda; N B Vardhaman, *Journal of Chemical and Pharmaceutical Research*, **2011**, 3(6) :1097-1102.
[15] N Sapui ; M H Zakaria ; J S Bujang , *Journal of Applied Sciences*, **2009**, 9 (16), 2969-2974.
[16] JN Ihedioha ; COB Okoye, *American Journal of Plant Nutrition and Fertilization Technology*, **2011**, 1, 55-63.
[17] N Sekeroglu ; O Faruk ; D Metin ; D Ozbay ; Y Nuri, *Asian Journal of Plant Sciences*, **2006**, 5 (2), 185-189.